IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

IN RE APPLICATION OF:	§	
Carl E. Whitcomb	§	
	§	EXAMINER: Nguyen, Son T.
SERIAL NO: 10/770,352	§	
	§	
CONFIRMATION NO.: 7661	§	
	§	GROUP ART UNIT: 3643
FILED: February 2, 2004	§	
	§	
FOR: Plant Container and Sidewall Providing Improved Management of Irrigation and Aeration	§	

REPLY BRIEF

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REPLY BRIEF

Appellant timely filed a Notice of Appeal to this Board on December 15, 2005 appealing the decision of the Examiner in the Final Office Action dated July 26, 2005 for the above captioned application. Appellant then submitted its Appeal Brief pursuant to 37 C.F.R. 41.37 on February 15, 2006. The Examiner's Answer was mailed on May 4, 2006. Since the two month period for reply fell on a federal holiday, July 4, 2006, the Applicant is timely filing this Reply Brief on July 5, 2006.

(1) Status of the Claims

The status of all claims in the application under appeal is as follows: claims 1-62 are pending in the application. Claims 41-45 and 51-62 have been withdrawn. Claims 1-40 and 46-50 stand rejected and are under appeal.

(2) GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

a. Whether claims 1-40 and 46-50 fail to comply with the enablement requirement under 35 U.S.C. 112, first paragraph.

b. Whether claims 1-4, 7, 11, 12, 20, 26, 27, 37-40, and 46 are anticipated under 35 U.S.C. 102(b) by Reynolds et al., U.S. 3,080,680.

c. Whether claims 5, 6, 8, 9, 14-16, 24, 32, 33, and 36 are unpatentable under 35 U.S.C. 103(a) over Reynolds et al., U.S. 3,080,680.

d. Whether claims 10, 13, 17-19, and 47-50 are unpatentable under 35 U.S.C. 103(a) over Reynolds et al., U.S. 3,080,680, in view of Reiger, U.S. 6,202,348.

e. Whether claim 21 is unpatentable under 35 U.S.C. 103(a) over Reynolds et al., U.S. 3,080,680, in view of Thomas, U.S. 5,311,700.

f. Whether claims 22 and 23 are unpatentable under 35 U.S.C. 103(a) over Reynolds et al., U.S. 3,080,680, in view of Berlit et al., GB 2073567.

g. Whether claims 25, 29, and 31 are unpatentable under 35 U.S.C. 103(a) over Reynolds et al., U.S. 3,080,680, in view of Van der Goorbergh, EP 300578A3.

h. Whether claims 28, 34, and 35 are unpatentable under 35 U.S.C. 103(a) over Reynolds et al., U.S. 3,080,680, in view of Flasch, Jr., U.S. 5,852,896.

i. Whether claim 30 is unpatentable under 35 U.S.C. 103(a) over Reynolds et al., U.S. 3,080,680, as modified by Berlit et al., GB 2073567, and further in view of Flasch, Jr., U.S. 5,852,896.

(3) ARGUMENT - REGARDING THE NEW REJECTION

a. Whether claims 1-40 and 46-50 fail to comply with the enablement requirement under 35 U.S.C. 112, first paragraph.

(1) Applicable law.

"The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention." 35 U.S.C. § 112, first paragraph. "The person of ordinary skill is a hypothetical person who is presumed to be aware of all the pertinent prior art." *Custom Accessories Inc. v. Jeffrey-Allan Indus.*, 807 F.2d 955, 1 USPQ2d 1196, 1201 (Fed. Cir. 1986).

"When rejecting a claim under the enablement requirement of Section 112, the [Patent Office] bears an initial burden of setting forth a reasonable explanation as to why it believes that the scope of protection provided by the claim is not adequately enabled by the description of the invention provided in the specification of the application; this includes, of course, providing sufficient reasons for doubting any assertions in the specification as to the scope of enablement." *In re Wright*, 999 F.2d 1557, 27 USPQ2d 1510, 1513 (Fed. Cir. 1993). "The question is whether the disclosure is sufficient to enable those skilled in the art to practice the claimed invention, hence the specification need not disclose what is well known in the art." *Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co.*, 730 F.2d 1452, 221 USPQ 481, 489 (Fed. Cir. 1984)(citing *In re Myerse*, 410 F.2d 420, 161 USPQ 668 (CCPA 1969)).

"[A] specification disclosure which contains a teaching of the manner and process of making and using the invention in terms which correspond in scope to those used in describing and defining the subject matter sought to be patented *must* be taken as in compliance with the enabling requirement of the first paragraph of § 112 *unless* there is reason to doubt the objective truth of the statements contained therein which must be relied on for enabling support. . . ." "[A]ny party making the assertion that a U.S. patent specification or claims fails, for one reason or another, to comply with § 112 bears the burden of persuasion in showing said lack of compliance." *Fiers v. Sugano*, 984 F.2d 1164, 25 USPQ2d 1601, 1607 (Fed. Cir. 1993)(quoting *In re Marzocchi*, 439 F.2d 220, 223, 169 USPQ 367, 269 (CCPA 1971)).

The enablement requirement found in Section 112, first paragraph, requires that the specification teaches one of ordinary skill in the art how to make and use the *claimed* invention. However, the enablement requirement does not require the specification to enable aspects of the invention that are not claimed. The PTO has the burden of giving reasons, supported by the record as a whole, why the specification is not enabling.

(1) The rejection does not establish *prima facie* nonenablement.

Applicant asserts that the Examiner has not met his burden of persuasion regarding nonenablement of the claimed invention. The brief paragraph asserting nonenablement does not provide sufficient reasons, supported by the record as a whole, why the specification is not enabling.

After reciting the text of Section 112, first paragraph (Answer, page 3, lines 10-13), stating the rejection (Answer, page 3, lines 14-15), and making an unsupported legal conclusion regarding nonenablement (Answer, page 3, lines 15-18), there are only two sentences that attempt to support this rejection. Neither of these two sentences complain about a lack of detail

regarding how to make and use the claimed invention. Rather, the two sentences complain about the mechanism by which root tips are trapped. (Answer, page 3, lines 18-23).

The rejection asserts that each of claims 1-40 and 46-50 are not enabled. However, the statement of the rejection does not point to *any* specific claim limitation that is not enabled. Furthermore, the statement of the rejection does not provide *any* support for the asserted nonenablement. Applicant asserts that the rejection is an unsupported assertion.

(2) The claimed invention.

Since each of claims 1-40 and 46-50 stand rejected as not being enabled, Applicant wishes to discuss at least the two independent claims, claim 1 and claim 46.

1. (original) A sidewall for a plant container, comprising:
a substantially water-impermeable root-tip-trapping region; and
a porous air-root-pruning region adjacent the root-tip-trapping region.

46. (original) A sidewall for a plant container, comprising:
a water permeable, porous fabric layer and a water impermeable, root-impenetrable layer bonded to a portion of the outer face of the fabric layer.

Applicant asserts that the rejection does not establish reasons that any of the claim terms are not described in the specification in such a manner that one of ordinary skill in the art would not be enabled to make and use the invention.

The two sentences of the rejection that actually discuss the invention (See Answer, page 3, lines 18-23) are directed to the mechanism of how root tips are trapped. Applicant maintains, as set out above, that this subject matter is not required for enabling one of ordinary skill in the art to *make and use* the invention. However, Applicant asserts that the phenomenon of root-tip-trapping itself, is not new to the claimed invention. U.S. Patent 4,442,628 issued on April 17, 1984 to the present inventor, Dr. Carl Whitcomb, describes how roots tips can be trapped. One of ordinary skill in the art is presumed to have knowledge of this reference and others that were

publicly available at the time of the invention. The present specification describes a further manner in which roots can be trapped, as described in the next three sections of this Reply Brief. Therefore, Applicant asserts that the nonenablement rejection is without basis as to claim 1. The statements accompanying the nonenablement rejection do not mention any limitation from claim 46.

(3) The specification and drawings provide a detailed explanation of how to ***make*** the invention.

Applicant asserts that the specification provides an enabling disclosure of how to *make* the invention of claim 1. Specifically, claim 1 describes "[a] sidewall for a plant container, comprising: a substantially water-impermeable root-tip-trapping region; and a porous air-root-pruning region adjacent the root-tip-trapping region.

The following descriptions provides an enabling description of how to *make* the sidewall of claim 1.

> [0009] The root-tip-trapping region is preferably formed by two layers bonded to one another to form a bilayer material. The bilayer material includes a root-tip-trapping layer that prevents the root tips from circling and a layer consisting of a root-impenetrable material formed onto a surface of the root-tip-trapping layer to prevent further advancement of the root tips. The root-tip-trapping layer is preferably a fabric, such as a spun bonded and needle punched fabric, a woven fabric, or a knitted fabric. The root-impenetrable material is preferably a polymer film, such as polyethylene, that is bonded to the root-tip-trapping layer. The root-impenetrable layer is preferably also water-impenetrable or water-impermeable.
>
> [0010] The air-root-pruning region is preferably formed with the same type of material as the root-tip-trapping layer of the root-tip-trapping region. Accordingly, the air-root-pruning material is preferably a fabric, such as a spun bonded and needle punched fabric, a woven fabric, or a knitted fabric.

US Application 10/770,352, paragraph [0009]-[0010].

> The bonding may be accomplished in a variety of ways, such as lamination or by means of an adhesive.

US Application 10/770,352, paragraph [0027].

(4) The specification and drawings provide a detailed explanation of how to *use* the invention.

Applicant asserts that the specification provides an enabling disclosure of how to *use* the invention of claim 1. Specifically, claim 1 describes "[a] sidewall for a plant container, comprising: a substantially water-impermeable root-tip-trapping region; and a porous air-root-pruning region adjacent the root-tip-trapping region.

The following description provides an enabling description of how to *use* the sidewall of claim 1.

> [0012] A method of using the sidewall or container to grow a plant is also provided. The method may be employed with rolls of the sidewall material. The method comprises the steps of disposing a layer of the sidewall material adjacent to a growth medium and providing a plant in the medium. The method may also be adapted to grow the plant in-ground, wherein the method comprises the steps of placing growth medium in a container including the sidewall material, disposing the container in soil, and adding a plant in the growth medium.

US Application 10/770,352, paragraph [0012].

> [0036] The present invention further provides methods of using the sidewalls in horticulture and recreational gardening. Rolls of the sidewall material, suitable for lining plant pots and other containers, may be produced. The sidewall may be used above ground by cutting strips of the bilayer and forming them into a lateral barrier lining the interior of a pot. For inhibition of roots growing in a basilar direction, a piece may be cut from the roll to line the bottom of the pot. However, in order for the sidewall to function optimally, it is necessary for the pot to have drain holes and it is beneficial for the drain holes to be very large to expose as much of the porous region of the sidewall as possible.

US Application 10/770,352, paragraph [0036].

(3) The specification provides a clear explanation addressing the examiner's concern over how roots are trapped.

Figures 4 and 6, and the discussions of those Figures (Specification, para. 41 and 43), are dedicated to describing the phenomena of root-tip-trapping.

[0041] Figure **4** is a partial perspective view of the same root-tip-trapping region **13** of the sidewall **17** shown in Figure **3** having a porous fabric **18**, such as a knit-type fabric, providing a high-density of discrete root-tip-trapping elements **28**. Plant roots **30** extend through a growth medium (not shown) to penetrate into the fabric layer **28** and root tips **34** that become trapped against the root-impenetrable layer **16**. As a result of root tips **34** becoming trapped, the root tips **34** swell somewhat, become more thick-bodied, give up control and allow side branches **31** to grow. This new root side branching occurs back approximately 4 inches from the tumescent root tip. These new side branches undergo a similar process when they become trapped in the sidewall **17**.

[0043] Figure **6** is a partial cross-sectional view of the sidewall **17** in the root-tip-trapping region **13** of the container **10** (similar to Figure **3**) illustrating how the tips **34** of the roots **30** enter into the layer of porous fabric **18** and impinge upon the root-impenetrable material **16** to become trapped. As in Figure **4**, it is an important effect of the invention that the root tips **34** swell and allow enhanced root side branches **31** to grow within the growth medium **32**. Accordingly, when the plant is removed from the sidewall **17**, or a container **10** made there from, the roots **31** will not be lost. In fact, the sidewall **17** may be easily peeled away from the roots with little or no damage to the roots.

US Application 10/770,352, paragraphs [0041] and [0043].

ARGUMENT - APPLICANT'S REPLY ARGUMENTS REGARDING THE EXAMINER'S RESPONSE TO ARGUMENT

The Examiner's Answer has dealt with each of the following issues/rejections in a consolidated manner. Applicant has chosen to restate the outstanding rejections, then address the Examiner's comments.

a. Whether claims 1-4, 7, 11, 12, 20, 26, 27, 37-40, 46 are anticipated under 35 U.S.C. 102(b) by Reynolds et al., U.S. 3,080,680.

b. Whether claims 5, 6, 8, 9, 14-16, 24, 32, 33, and 36 are unpatentable under 35 U.S.C. 103(a) over Reynolds et al., U.S. 3,080,680.

c. Whether claims 10, 13, 17-19, 47-50 are unpatentable under 35 U.S.C. 103(a) over Reynolds et al., U.S. 3,080,680, in view of Reiger, U.S. 6,202,348.

d. Whether claim 21 is unpatentable under 35 U.S.C. 103(a) over Reynolds et al., U.S. 3,080,680, in view of Thomas, U.S. 5,311,700.

e. Whether claims 22, 23 are unpatentable under 35 U.S.C. 103(a) over Reynolds et al., U.S. 3,080,680, in view of Berlit et al., GB 2073567.

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g. Whether claims 28, 34, 35 are unpatentable under 35 U.S.C. 103(a) over Reynolds et al., U.S. 3,080,680, in view of Flasch, Jr., U.S. 5,852,896.

h. Whether claim 30 is unpatentable under 35 U.S.C. 103(a) over Reynolds et al., U.S. 3,080,680, as modified by Berlit et al., GB 2073567, and further in view of Flasch, Jr., U.S. 5,852,896.

(1) "Root-tip-trapping."

The invention of the present *claims* is clear. Claim 1 is patentable because none of the prior art teaches or suggests the combination of a root-tip-trapping region and an air-root-pruning region in the same sidewall. The examiner's focus on how roots are trapped is misplaced. As stated above, one having ordinary skill in the art would understand what these two pruning techniques involve and would be able to make and use these two regions in a sidewall after reading the present specification. The structures described in the present specification, as well as those known in the prior art or incorporated by reference into the present specification, provide sufficient enablement for the invention of claim 1.

The examiner confusingly compares Reynolds with the claimed invention, yet Reynolds does not teach two bonded layers as described in one embodiment of the present specification. The fact that Reynolds teaches a root will grow between two loose layers does not means that roots will grow between two bonded layers.

Applicant's specification has clearly shown, in one embodiment of the invention, that the root-tip-trapping material may be made from two layers **17**, **18** and is used in an upper region **13** of the sidewall, for example. (See Figures 1 and 2). Similarly, the air-root-pruning material is made from layer **18** alone and is used in a lower region **20** of the sidewall. (See Figures 1 and 2). Accordingly, it is clear that Applicant has used the term "region" in a common manner to describe a surface or area of the sidewall. The Examiner's continued interpretation of a "root-tip-trapping region" as being the space between sheet 60 and pot 18 in Reynolds is improper as being entirely inconsistent with the present specification.

(2) "Sidewall."

The reason for the examiner's reference to the meaning of the term "comprising" is not understood. Regardless, the specification clearly refers to a sidewall as distinct from a bottom. That Lai may refer to his bottom as a "bottom sidewall," does not dictate that one of ordinary skill in the art does not understand that a particular description may adopt a "sidewall" as distinct from a "bottom."

(3) Reynolds.

As discussed above, Reynolds does not teach, show or suggest root-tip-trapping.

(4) "Protuberance."

The examiner asserts that Reiger inherently teaches a "protuberance" because he has a "fuzzy surface." However, the claim limitation that is at issue in claim 10 is "protuberances having outwardly extending distal ends that are closed to trap roots." Even under the examiner's unreasonably broad reading of this term, Reiger does not teach protuberances having outwardly extending distal ends that are closed to trap roots. The entire claim must be considered.

Therefore, because the cited prior art reference fails to disclose each and every limitation of the claims, Appellant respectfully asserts that the examiner has not made out a *prima facie* case of anticipation nor a *prima facie* case of obviousness. Therefore, Appellant respectfully requests the Board to reverse the present rejections and find that claims 1-40 and 46-50 presented on appeal are patentable.

Respectfully submitted,

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APPENDIX IN SUPPORT OF APPELLANT'S APPEAL BRIEF

(4) Claims Appendix

What is claimed is:

1. (original) A sidewall for a plant container, comprising:

a substantially water-impermeable root-tip-trapping region; and

a porous air-root-pruning region adjacent the root-tip-trapping region.

2. (original) The sidewall of claim 1, wherein the root-tip-trapping region is colinear with the air-root-pruning region.

3. (original) The sidewall of claim 1, wherein the root-tip-trapping region comprises a porous fabric layer bonded to a layer of a root-impenetrable material.

4. (original) The sidewall of claim 1, wherein the root-tip-trapping region is a contiguous upper portion of the sidewall and the air-root-pruning region is a contiguous lower portion of the sidewall.

5. (original) The sidewall of claim 1, wherein the root-tip-trapping region comprises between 1/2 and 9/10 of the sidewall.

6. (original) The sidewall of claim 1, wherein the root-tip-trapping region comprises between 2/3 and 3/4 of the sidewall.

7. (original) The sidewall of claim 1, wherein the sidewall is flexible, rigid, or a combination thereof.

8. (original) The sidewall of claim 1, wherein the root-tip-trapping and air-root-pruning regions form a bendable sheet.

9. (original) The sidewall of claim 1, wherein the air-root-pruning region includes protuberances having outwardly extending distal ends that are open.

10. (original) The sidewall of claim 1, wherein the root-tip-trapping region includes protuberances having outwardly extending distal ends that are closed to trap roots.

11. (original) The sidewall of claim 1, wherein the edge of the sidewall is secured by a method selected from sewing, gluing, plastic welding, hooking, rivoting, screwing, bolting, bonding, and combinations thereof.

12. (original) The sidewall of claim 3, wherein the root-impenetrable material is water-impermeable.

13. (original) The sidewall of claim 1, wherein the root-tip-trapping region comprises greater than 10 root-tip-trapping elements per square inch.

14. (original) The sidewall of claim 3, wherein the porous fabric has a weight between 2 and 10 ounces per square yard.

15. (original) The sidewall of claim 3, wherein the porous fabric has a weight between 4 and 6 ounces per square yard.

16. (original) The sidewall of claim 3, wherein the porous fabric has openings between 1/16 and ¼ inch.

17. (original) The sidewall of claim 3, wherein the porous fabric is a spun bonded, needle punched fabric.

18. (original) The sidewall of claim 3, wherein the porous fabric is selected from polyester, polypropylene or other olefin fiber.

19. (original) The sidewall of claim 3, wherein the porous fabric is a woven or knitted fabric.

20. (original) The sidewall of claim 3, wherein the porous fabric is degradable.

21. (original) The sidewall of claim 3, wherein the porous fabric is cotton.

22. (original) The sidewall of claim 3, wherein the porous fabric is opaque.

23. (original) The sidewall of claim 22, wherein the porous fabric is black or gray.

24. (original) The sidewall of claim 3, wherein the porous fabric is bonded onto the root-impenetrable material by a method selected from gluing, laminating and combinations thereof.

25. (original) The sidewall of claim 3, wherein the root-impenetrable material is reflective.

26. (original) The sidewall of claim 3, wherein the root-impenetrable material is a polymer sheet.

27. (original) The sidewall of claim 3, wherein the root-impenetrable material is selected from polyethylene and polypropylene.

28. (original) The sidewall of claim 3, wherein the root-impenetrable material is metal.

29. (original) The sidewall of claim 3, wherein the root-impenetrable material is a metal foil.

30. (original) The sidewall of claim 22, wherein the root-impenetrable layer is pervious to UV radiation.

31. (original) The sidewall of claim 3, wherein the root-impenetrable material is white.

32. (original) The sidewall of claim 3, wherein the root-impenetrable layer has a thickness between 2 and 10 mils.

33. (original) The sidewall of claim 3, wherein the root-impenetrable layer has a thickness between 3 and 5 mils.

34. (original) The sidewall of claim 3, wherein the root-impenetrable material is biodegradable.

35. (original) The sidewall of claim 34, wherein the biodegradable material is selected from wood, fiber, starch, polyhydroxyalkanoates, polycaprolactone, polylactide aliphatic copolymer, polylactide, aliphatic polyester, an aliphatic-aromatic copolymer, and combinations thereof.

36. (original) The sidewall of claim 1, wherein the regions are configured in a pattern selected from rows, columns, dots, checkerboard, and combinations thereof.

37. (original) The sidewall of claim 1, wherein the sidewall is an integral part of a container.

38. (original) The sidewall of claim 1, wherein the sidewall is a discrete panel that can form a container.

39. (original) The sidewall of claim 1, wherein there are two or more root-tip-trapping regions.

40. (original) The sidewall of claim 1, wherein there are two or more air-root-pruning regions.

41. (withdrawn) A container formed by bending and securing opposed edges of one or more sidewall panels together, wherein the sidewall comprises a substantially water-impermeable root-tip-trapping region and a porous air-root-pruning region adjacent the root-tip-trapping region.

42. (withdrawn) The container of claim 41, wherein the root-tip-trapping region is a contiguous upper portion of the sidewall and the air-root-pruning region is a contiguous lower portion of the sidewall, and wherein the root-tip-trapping region comprises between 1/2 and 9/10 of the sidewall.

43. (withdrawn) The container of claim 41, wherein the root-tip-trapping region comprises a root-impenetrable sheet bonded to a porous fabric having openings with a diameter between 1/16 and ¼ inch.

44. (withdrawn) The container of claim 43, wherein the root-impenetrable material is selected from polyethylene and polypropylene.

45. (withdrawn) The sidewall of claim 43, wherein the porous fabric is a spun bonded, needle punched fabric.

46. (original) A sidewall for a plant container, comprising:

a water permeable, porous fabric layer and a water impermeable, root-impenetrable layer bonded to a portion of the outer face of the fabric layer.

47. (original) The apparatus of claim 46, wherein the porous fabric is a spun bonded, needle punched fabric.

48. (original) The apparatus of claim 47, wherein the fabric has a density between 2 and 10 ounces per square yard.

49. (original) The apparatus of claim 46, wherein the root-impenetrable layer comprises polyethylene and the porous fabric comprises spun bonded fabric.

50. (original) The apparatus of claim 49, wherein the polyethylene has a thickness between 2 and 10 mils.

51. (withdrawn) A method of growing a plant in a pot comprising the steps of:

air-pruning roots of the plant in a lower sidewall portion of the pot; and

trapping root tips of the plant in an upper sidewall portion of the pot.

52. (withdrawn) The method of claim 51, further comprising:

preventing water loss through the upper sidewall portion of the pot.

53. (withdrawn) The method of claim 52, further comprising:

draining excess water out of the pot through the lower sidewall portion of the pot.

54. (withdrawn) The method of claim 53, further comprising:

providing oxygen to the roots through the lower sidewall portion of the pot.

55. (withdrawn) A plant container, comprising:

a water permeable, porous fabric layer; and

a water impermeable polymer layer stretch-wrapped around a portion of the outer face of the fabric layer.

56. (withdrawn) The apparatus of claim 46, wherein the porous fabric is a spun bonded, needle punched fabric.

57. (withdrawn) The apparatus of claim 47, wherein the fabric has a density between 2 and 10 ounces per square yard.

58. (withdrawn) The apparatus of claim 46, wherein the root-impenetrable layer comprises polyethylene and the porous fabric comprises spun bonded fabric.

59. (withdrawn) The apparatus of claim 49, wherein the polyethylene has a thickness between 2 and 10 mils.

60. (withdrawn) A method of preparing a growth environment for a plant, comprising:

disposing growth medium in a container having a water permeable, porous fabric sidewall; and

stretch-wrapping the upper ½ to 9/10 of the sidewall with a water conserving polymer film.

61. (withdrawn) The method of claim 50, wherein the polymer film is selected from polyethylene, polypropylene, polybutylene, and polyvinylchloride.

62. (withdrawn) The method of claim 51, wherein the porous fabric is spun bonded, needle punched fabric.

(5) Evidence Appendix

U.S. Patent No. 4,442,628 issued on April 17, 1984

United States Patent [19]

Whitcomb

[11] **4,442,628**

[45] **Apr. 17, 1984**

[54] **ROOT-PRUNING CONTAINER**

[75] Inventor: **Carl E. Whitcomb, Stillwater, Okla.**

[73] Assignee: **Board of Regents for Oklahoma Agricultural & Mechanical Colleges Acting for Oklahoma State University, Stillwater, Okla.**

[21] Appl. No.: **486,985**

[22] Filed: **Apr. 20, 1983**

[51] **Int. Cl.**[3] **A01G 31/00**

[52] **U.S. Cl.** **47/66; 47/73**

[58] **Field of Search** 47/66, 73, 77, 85, 86, 47/87

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,339,310	9/1967	Solomon	47/66
3,800,469	4/1974	Lau, Jr. et al.	47/66
4,057,931	11/1977	Stutelberg et al.	47/66

Primary Examiner—Robert A. Hafer

Assistant Examiner—Bradley M. Lewis

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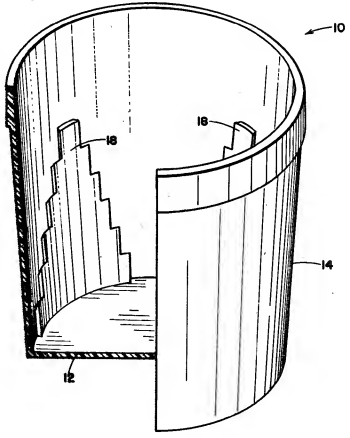
[57] **ABSTRACT**

A root-pruning container involving a series of vertical pyramid like staircase stepped surfaces essentially parallel to the sidewall of said container and displaced to the inside of said container, wherein the vertical and horizontal surfaces forming the steps between the inner pyramid like surface and the outer container sidewall are intentionally sloped behind said pyramidal surface such as to form an acute angle of intersection with the container's sidewall. Because of the acute angle of the step, the root tips of a growing plant are directed into and trapped at the toe position of each individual step resulting in termination of the root growth (root-pruning). Such a container inhibits spiral growth, promotes root branching and results in more even root distribution as well as increased root growth in the growing medium.

5 Claims, 6 Drawing Figures



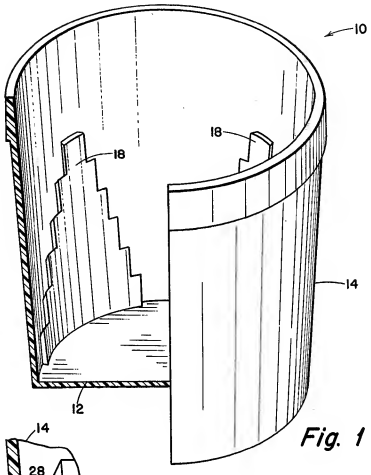


Fig. 1

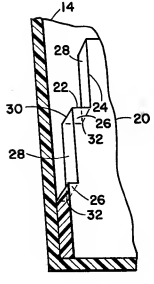


Fig. 5

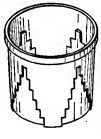


Fig. 6

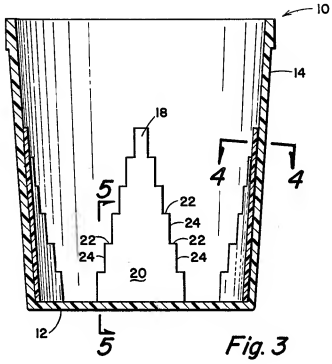


Fig. 3

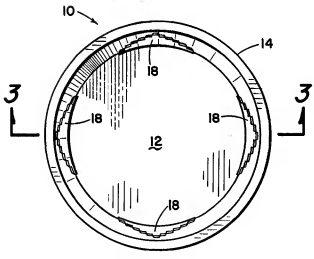


Fig. 2

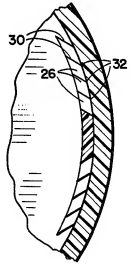


Fig. 4

ROOT-PRUNING CONTAINER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an improved nursery or greenhouse container or pot. More specifically, the invention relates to an apparatus and method for root-pruning of plants grown in containers.

2. Description of the Prior Art

Plants have long been grown in pots in greenhouses and homes. The practice of producing large numbers of plants out-of-doors in containers has developed primarily since the early 1950's. The container nursery industry began in southern California and spread across the southern states. The #10 food can with a few holes punched in the bottom was widely used and soon became known as the "one gallon container". During the sixties and seventies, the container nursery industry increased rapidly for several reasons: (1) landscape plants grew at a faster rate in containers than in the field; (2) turnover time decreased; (3) the root system of the plant remained undistrubed; thus, planting could be done anytime, not just during the early spring as as with bare root or balled-in-burlap nursery stock; and (4) ease of display and handling made container grown plants attractive to the consumer.

However, development of the container nursery industry was not without problems. The complex nutritional requirements of plants grown in containers took years to define. In addition, growing media was refined until the quality of plant growth in containers attained that of field grown plants. The medium for the container evolved from field soil, to mixes of field soil and compost, to soil-less mixes with far greater pore space for providing oxygen to the root system.

Numerous articles have been written and a common topic at gatherings of nurserymen is root development, especially of woody plants, in containers. As a root grows from a cutting or seedling in a container, its path is outward (towards the side of the container) and downward. When the root reaches the side of a round container, it follows the contour and generally after one half to one full circle, reaches the bottom where it may continue to elongate and circle, sometimes for five or more revolutions, all of which is considered to be deleterious to the plant.

In "Growth of *Carissa grandiflora* 'Boxwood Beauty' in varying media, containers, micronutrient levels", *The Florida Nurseryman*, 17 (4): 12–13, 43 (1972) Whitcomb tried placing holes in the sides of containers to improve root growth but without success (see also U.S. Pat. No. 3,785,088). Later studies with tree seedlings grown in square bottomless containers on a raised wire bench showed that air-root-pruning was effective in stopping root elongation and wrapping at the bottom of the container and, at the same time, in stimulating lateral branch root development following the death of the root tip, Davis et al, "Effects of Propagation Container Size on Development of High Quality Tree Seedling", *Proc. Int. Plant Soc.*; 25:448–453 (1975). More recent studies showed that Bur oak trees (*Quercus macrocarpa*) grew larger and developed a more fibrous root system in a square bottomless container than in a conventional round container of the same volume, Hathaway and Whitcomb, "The Effects of Root Malformation during Propagation on Growth and Survival of Bur Oak", Research Report P-760, Oklahoma Agricultural Experimental Station, Oklahoma State University, pages 33–34 (1977). Unfortunately, growing plants in bottomless containers on raised wire benches is neither practical nor economical. Birchell and Whitcomb, "Effects of Container Design on Root Development and Regeneration", Research Report P-760, Oklahoma Agricultural Experimental Station, Oklahoma State University, pages 39–45 (1977) compared the growth of birch trees grown in bottomless containers with vertical ribs on the sides. The vertical ribs stopped the circling or the wrapping of the roots of a fine, fibrous rooted species such as the birch. In addition, when the vertical ribs were present, there was no advantage to removing the bottom of the container for air-pruning. Dickson and Whitcomb, "Effects of Container Design on Root Quality", Research Report P-760, Oklahoma Agricultural Experimental Station, Oklahoma State University, pages 35–36 (1977) tried placing ribs across the bottom of a round container and vertical ribs one fourth to one half the height of the sidewall of the container in order that the container could be nested for stacking and shipping. Japanese black pine (*Pinus thunberi*) and bald cypress (*Taxodium distichum*) trees were grown in these containers for one growing season. The vertical ribs in the lower one fourth or one half of the container were effective in stopping circling of the pine roots; however, the more coarsely rooted cypress either bent the rib and continued to circle or was stopped by the rib from circling but continued to elongate creating a "tangled ball of string" effect.

Dickinson and Whitcomb, "The Effects of Spring Versus Fall Planting on Establishment of Landscape Plants", *S.N.A. Nursery Research Journal* 4 (1): 9–19 (1977) observed that the roots of container grown plants that developed following planting were extensions of roots that were already present in the container at the time of planting, and were not "new" roots. They suggest that the number of root tips present at planting time may be very important to the rapid establishment and frequently the survival of the container grown plants in the landscape.

These studies showed that the root system of a plant grown in a container could be improved (a) as in the case of bottomless containers on a wire bench and (b) that vertical ribs on the inside of the container could improve the root structure of fine, fibrous rooted plants, but only worsened the problem for strong, coarsely rooted plants. Also, neither improvement was practical for the production of nursery stock on a commercial scale.

SUMMARY OF THE INVENTION

In view of the problems associated with root development in plants grown in containers, I have discovered an improved container adapted to contain a growing medium and a plant comprising:

(a) a bottom wall;

(b) a circumferential upwardly extending sidewall attached to the perimeter of the bottom wall thus forming an open-topped container; and

(c) at least one root-pruning means comprising an inner sidewall segment essentially parallel to the circumferentially upwardly extending sidewall and displaced to the inside of the open-topped container wherein the perimeter of the inner sidewall segment is a plurality of vertical and horizontal intersecting edges proceeding from the bottom of the container to the top

of the inner sidewall segment on both sides of the inner sidewall segment thus forming a pyramid like series of steps and wherein the vertical and horizontal edges of the pyramid like series of steps are connected to the circumferentially upwardly extending sidewall by essentially flat surfaces that recede behind the inner sidewall segment at an acute angle to the circumferential upwardly extending sidewall, thus forming root-pruning traps at the toe position of each of the steps.

The present invention further provides that a plurality of root-pruning means be distributed about the inner surface of the container and that each employ a plurality of steps ascending each side of the root-pruning means (e.g., four pyramidal staircases of up to six steps evenly distributed around the inside of a one gallon nursery container). Preferably, the root-pruning means (e.g., pyramidal staircase of sloped steps) can be fabricated into the interior of the nursery container sidewall at the time of manufacturing the container. In this manner, the exterior of the sidewall of the container at the location of the pyramidal staircase can be recessed such as to allow the container to be stacked when not in use.

Thus the present invention provides in a process for growing a plant in a growing medium contained in a pot having a bottom and a circumferential sidewall the specific improvement comprising the step of pruning the roots of the plant along one or more interior step formed between an interior sidewall segment essentially parallel to the circumferential sidewall and displaced to the inside of the circumferential sidewall and a series of essentially vertical and horizontal surfaces therebetween wherein the vertical and horizontal surfaces recede behind the inner sidewall segment and intersect the circumferential sidewall at an acute angle forming root-pruning trap at the top position of the step, thus inhibiting the tendency of the roots to grow in a spiral and stimulating additional root branching.

It is an object of the present invention to provide a container that prunes the roots of the plant growing in the container. It is a further object that this pruning take place along root traps distributed around the container sidewalls such as to prevent spiral root growth and such as to promote root branching. It is a further object that the container be consistent and essentially interchangeable with containers presently used in the commercial container industry for growing plants. Fulfillment of these objects and the presence and fulfillment of other objects will be readily apparent upon complete reading of this specification and claims taken in conjunction with the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a partial cut-away perspective view of a nursery stock container equipped with a root-pruning structure within the container according to the present invention.

FIG. **2** is a top view of the container of FIG. **1**.

FIG. **3** is a cut-away side view of the container of FIG. **2** as seen through line A—A.

FIG. **4** is a cross-sectional top view of the root-pruning structure illustrated in FIG. **3** as seen through line B—B.

FIG. **5** is a cross-sectional side view of the root-pruning structure illustrated in FIG. **3** as seen through line C—C.

FIG. **6** is a perspective view of an alternate embodiment of the container according to the present invention illustrating external recesses in the container sidewall which more readily accommodate stacking of the container when not in use.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The root-pruning container of the present invention, how it functions and how it differs from other nursery stock containers can perhaps be best explained and understood by referencing the drawings. The figures illustrate one embodiment of a root-pruning container according to the present invention, generally designated by the numeral **10**. As seen in FIG. **1**, the container **10** is made up of a circular flat bottom **12** and a circumferential upwardly and outwardly sidewall **14** attached to the perimeter of the bottom **12**. Displaced around the inner surface of the container are a series of four essentially vertical root-pruning means **18**, each evenly distributed around the sidewall **14** (approximately every six inches for one gallon container). With a larger container, say twelve inches in diameter, there would preferably be six or more root-pruning means, again evenly distributed, to give optimum root-pruning. Likewise, in a smaller pot only two or three root-pruning means may be needed.

As illustrated in FIG. **3**, each root-pruning means **18** involves a pyramid like surface **20** essentially parallel to the container sidewall **14**, but displaced to the inside of the container **10**. As shown, the perimeter of the surface **20** is comprised of a series of horizontal and vertical edges **22** and **24** intersecting at essentially right angles creating what appears to be a staircase profile as viewed from within the container.

As illustrated in FIGS. **4** and **5**, a series of essentially flat surfaces **26** and **28** extend from the horizontal and vertical edges **22** and **24**, respectively, of surface **20** to the inside of container sidewall **14**. Both horizontal and vertical surfaces **26** and **28** recede behind surface **20** as they approach sidewall **14**, thus forming acute angles at the intersection. Consequently, the series of surfaces **26** and **28** intersect with each other forming a series of steps **30** wherein the toe position of the respective steps are sloped towards the sidewall **14** forming a series of root traps **32**.

Because of the pyramid like profile or configuration of the root-pruning structure, the root traps are distributed at various elevations from the bottom of the container and are also distributed radially around the inner surface of the sidewall of the container. In this manner, the root growth of the plant being grown in the container will propagate outwardly and downwardly until it is turned by the presence of the container sidewall. The root then proceeds to encircle the container along the curved sidewall until it strikes a root-pruning structure **18**. Surfaces **26** and **28** of steps **30** will then direct the root growth into the trap **32** whereupon further growth abruptly stops. Because of the physical entrapment of the root and cessation of growth, the root responds as if it were physically pruned in that secondary branching takes place on the terminated root. This in turn leads to a very fibrous root structure free of the conventional root swirl common to container grown plants. The marked increase in the number of root tips existing in the container aids in restabling the plant upon transplanting from the container.

In testing the new container design, young Virginia pine plants were grown in the new root-pruning containers and in conventional plastic containers with smooth interiors under identical conditions. After four

months of growth in the respective pots, the pine trees were terminated and the root structures were examined and compared. A 300 percent increase in root branching (i.e., 2,644 roots versus 868 roots) were observed for the root-pruning container grown plant relative to the smooth walled grown plant. Physical examination of the root-pruning container grown plant further indicated that the tip of the root was, in fact, trapped in one of the stair step corners. This physical restriction to further elongation of the root caused branching to occur much like air-root-pruning. Furthermore, the absence of root swirl or spiral growth was observed in the root-pruning container.

With plants grown in the conventional container, only a few root tips exist at the bottom of the container. At the time of planting in the landscape, these root tips extend into the surrounding soil. Thus, in the case of the plant grown in the root-pruning container, the marked increase in the number of root tips existing at planting time results in accelerated establishment of the plant in the landscape. The more even distribution of root development throughout the container medium, instead of most roots developing in a spiral pattern on the very bottom of the container, further promotes accelerated establishment of the plant. Stimulated branch root development enhances further plant growth by increasing the root surface area which in turn promotes increased absorption of water and nutriments.

Additional advantages associated with the use of the root-pruning container of the present invention include the fact that the container has a conventional bottom for ease of filling, handling, and shipping. The containers can be filled by existing commercial pot fillers without modification. The root-pruning container according to the present invention can be manufactured by any of the methods well known in the art out of essentially any of the conventionally used materials. Preferably, the container with root-pruning means is fabricated by blow molding, injection molding or the like using a conventional thermoplastic resin or the equivalent. As such, the containers will nest or stack such that freight costs for shipping the containers from manufacturers to nurserymen is not increased.

Having thus described the preferred embodiments with a certain degree of particularity, it is manifest that many changes can be made in the details of construction, arrangement and fabrication of the elements without departing from the spirit and scope of the invention. Therefore, it is to be understood that the invention is not limited to the embodiments set forth herein for purposes of exemplification, but is to be limited only by the scope of the attached claims, including the full range of equivalents to which each element thereof is entitled.

I claim:

1. A container adapted to contain a growing medium and a plant comprising:

(a) a bottom wall;

(b) a circumferentially upwardly extending sidewall attached to the perimeter of said bottom wall thus forming an open-topped container: and

(c) at least one root pruning means comprising an inner sidewall segment essentially parallel to said circumferentially upwardly extending sidewall and displaced to the inside of said open-topped container wherein the perimeter of said inner sidewall segment is a plurality of vertical and horizontal intersecting edges proceeding from the bottom of said container to the top of said inner sidewall segment on both sides of said inner sidewall segment thus forming a pyramid like series of steps and wherein the vertical and horizontal edges of said pyramid like series of steps are connected to said circumferentially upwardly extending sidewall by essentially flat surfaces that recede behind said inner sidewall segment at an acute angle to said circumferential upwardly extending sidewall, thus forming root-pruning traps at the toe position of each of said steps.

2. A container of claim 1 wherein a plurality of said root-pruning means are distributed about the inner surface of said container.

3. A container of claim 2 wherein four of said root-pruning means are employed with a plurality of steps ascending each side of said pyramid like inner sidewall segment of each of said root-pruning means.

4. In a container for growing nursery stock, the specific improvement comprising; a plurality of root-pruning means wherein each root-pruning means comprises:

(a) an inner sidewall segment essentially parallel to said circumferentially upwardly extending sidewall and displaced to the inside of said open-topped container wherein the perimeter of said inner sidewall segment is a plurality of vertical and horizontal intersecting edges proceeding from the bottom of said container to the top of said inner sidewall segment on both sides of said inner sidewall segment thus forming a pyramid like series of steps and wherein the vertical and horizontal edges of said pyramid like series of steps are connected to said circumferentially upwardly extending sidewall by essentially flat surfaces that recede behind said inner sidewall segment at an acute angle to said circumferential upwardly extending sidewall, thus forming root-pruning traps at the toe position of each of said steps.

5. In a process for growing a plant in a growing medium contained in a pot having a bottom and circumferential sidewall, the specific improvement comprising the step of pruning roots of said plant along at least one interior step formed between an interior sidewall segment essentially parallel to said circumferential sidewall and displaced to the inside of said circumferential sidewall and a series of essentially vertical and horizontal surfaces therebetween wherein said vertical and horizontal surfaces recede behind said inner sidewall segment and intersect said circumferential sidewall at an acute angle forming a root-pruning trap at the toe position of said step, thus inhibiting the tendency of said roots to grow in a spiral and stimulating additional root branching.

* * * * *